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AUTHOR Braun, Thomas G.
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ABSTRACT

The Council of Public Higher Education, Kentucky's higher education coordinating body, has developed a five-year plan to provide computing, consulting, and communication services for all of the public higher educational community, regardless of the size of the institution. The proposal includes a centralized network which provides instructional, research, and administrative services to participating institutions. Since the network serves a variety of different needs, diversity has been provided for by encouraging individualized equipment selection and independent creation of computer programs. The program, called Kentucky Educational Computer Network (KECNET), is managed by the Kentucky Educational Computer Board, a representative committee which makes crucial policy decisions. (EMH)

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"Networking in Higher Education: A Statewide Plan"

Thomas G. Braun
Coordinator of Information and Data Systems
Kentucky Council on Public Higher Education

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Networking in Higher Education: A Statewide Plan

Thomas G. Braun
Coordinator of Information and Data Systems
Kentucky Council on Public Higher Education

As we move into the second half of the decade of the 70's, a bit of reflection over the past five years brings a realization that some rather significant changes in traditional viewpoints have occurred. Our political structure is undergoing a close scrutiny with, no doubt, substantial changes as the result. Our economy has caused many past economic theories to be questioned. Social values have changed significantly creating more demands on tax dollars for services.

Perhaps all of the upheaval we are experiencing has placed an emphasis on cost consciousness or accountability particularly in those tax supported areas such as public higher education. Suddenly the education coffers that in the 60's were filled on request, now require some rather substantial justifications before funding is made available. All facets of higher education have begun to feel the pinch and an effort to better utilize resources has become a way of life for tax supported institutions.

One phenomenon that appears to be developing into a trend in higher education is toward centralization in the governance of higher education. This is manifest through the establishment of strong statewide governing boards or through the strengthening of statewide coordinating agencies. One needs only to review the events of the past ten years to realize the effort toward centralization is nationwide in scope. This is not the forum to debate the pros and cons of this movement. Rather if we can assume this trend, it can be viewed as the foundation for much of what is happening in higher education today with regard to the acquisition and use of computers.

Central Coordination of Computing

A primary concern of the central coordinating body for computing is to assure access to computing services to all regardless of the size and financial capacity of a particular institution. If all institutions were identical in size, role and scope, and financial ability one might conclude that a particular computer could be located on each campus to serve that institution's requirements; however, the hardware requirements for providing computer services are not necessarily the major constraint, particularly as the cost of hardware continues to decline.

In most instances the major concern is to provide adequate staff to maintain the level and diversities of computing services required of an educational institution.

There seems to be a great deal of logic in the sharing of computer expertise through statewide coordination as there is in the sharing of

hardware. Although most of the networks currently in operation were developed around the concept of hardware sharing, to better utilize scarce resources, a secondary benefit which may become the primary benefit is that of sharing knowledge. Any efforts toward coordination of computing should address both the hardware and human elements associated with providing the service.

Toward a Plan for Computing Services

The statewide coordinating body for public higher education in Kentucky is the Council on Public Higher Education. That agency is responsible for the development of a long range master plan for higher education in the state.

A number of task groups were established by the Council and directed to develop five-year plans for various segments of higher education, one of those being the plan for providing computing services to the higher education community. These task groups were composed of representatives from each of the eight institutions of public higher education and a representative of the private sector. Specifically the charge to the Computing Services Policy Committee was:

> To investigate, evaluate, and recommend alternatives to provide optimum services to all institutions in the system of public higher education. Further, to develop and maintain a master plan for computing services in higher education with at least a five year projection of needs.

Perhaps an added incentive to hurry along the development of the Kentucky plan was the realignment of the computing resource in state government. The state agencies were experiencing the throes of hardware centralization. Rumors abounded that higher education would be assimilated along with state government. One can imagine the distress which accompanied that thought. Certainly, the very threat of such a merger created an enthusiasm which greatly facilitated the development of the computing plan for higher education.

Philosophical Basis for Providing Computing Services

The initial premise from which the plan is to be generated is that access to computing and its accouterments should be a right rather than a priviledge and should be available equally to all members of the higher education community from the smallest community college to the largest multi-campus university. At this time there are varying degrees of computing capacity available from institution to institution. The Council on Public Higher Education recognized the need for a plan to distribute computing resources better and to assure the most efficient and effective utilization of those computing resources, as possible, given certain practical constraints.

In addition, it is essential that planning and development efforts for computing come from within the higher education community with full participation by institutional representatives rather than have policies imposed by external agencies which do not have the advantage of a deep understanding of the needs of higher education.

Institutional autonomy would be maintained if the individual institutions have a high level of participation in the policy making process. In essence perhaps the overall one advantage to concentration of computing efforts would be the development of a strong working relationship among the institutions which could pave the way for additional projects in other areas.

The overall advantages which should be realized from a centralized focus on the computing resource are:

1. Economies of scale in terms of hardware and technical expertise required to support the hardware.

2. A focal point for the concentration of expertise to develop computer applications which are capable of servicing the entire higher education community.

3. A standardization of procedures which generate data for use in comparative analysis and other analytical activities.

4. A sharing of ideas and conceptual designs for computer use which assures the least member the advantages of the largest institution.

5. A better rapport could develop among the institutions and CPHE through this particular activity.

6. Substitute for the "institutional prestige concept" of having the largest computer by the concept of being the most effective user of the computing resource.

7. Provide computing where it is needed regardless of the institution's size.

As the expanded use of computing pervades the various sectors of the institutions, it is expected that significant adjustments to types of computing services required at the institution will occur. Each time a major request for hardware is submitted or needs for computer services proposed, the effect on the total needs for higher education should be evaluated and as many alternatives as practical reviewed before reaching a decision.

The Plan

After long deliberation, the Computing Services Policy Committee

adopted a set of assumptions regarded as basic to the development of a five-year plan for computing services to public higher education in Kentucky. The ten assumptions are that:

1. the role of computing services in higher education will be an ever-increasing one during the next five-year period.

   Computing services as herein used includes adequate hardware, software and personnel support.

2. the development of computing services in higher education will be required to compete with other elements of higher education in a context of greater fiscal restraint.

3. while the greatest application of computing services in higher education in the past has been in the areas of research and administration, in the next five years relatively greater emphasis for expansion will occur in the areas of computer-aided instruction and computer-related instruction.

4. The role of computing services in higher educational institutions will continue to be that of service to programs in the following general areas:

   a. Administration
   b. Computer-related instruction
   c. Computer-assisted instruction
   d. Research

5. Institutions will vary in the determination of needs for computing services in these areas, depending, in part, upon the role and scope of each institution.

6. Computing services necessary to meet the needs of higher educational institutions will require the availability of a wide range of computer facilities determined by the complexity of the programs and the response time necessary in the operations.

7. much benefit will accrue from progress in systems development, and that emphasis must be placed on coordination of such development between and among institutions.

8. Additional computing services required by the institutions of higher education and other institutions will be made available from the following:

   a. Expansion of on-campus computer facilities
   b. Institutional cooperative arrangements including computer networks.

9. Any system of computing services for higher education in Kentucky will have various interfaces with computing services external to the state.

10. In order to achieve successful implementation, any system of computing services for higher education must be user-oriented in its philosophy.

PRINCIPLES

Colleges and universities are complex institutions, the administration of which is becoming increasingly dependent upon computing services. While a plan which does not provide adequately for administrative data processing would be incomplete and unrealistic, it is recognized that education is the primary mission and function of the institutions involved. Accordingly, increasing demands for administrative computing must not be permitted to compromise the application of computing services on behalf of instruction and research.

Computing should not be viewed as a technology independent of the academic programs which it serves. The focus of this plan is computing services - not computing hardware. Because of the dynamic involvement of computing in teaching and research, decisions regarding computing services are decisions directly involving academic programs. Thus, such decisions should be based on the input of academic personnel and not made independently by agencies external to a given institution. To do so would be to dictate academic policies and programs.

It is expected that diversity will characterize the utilization of computing services by the various colleges and universities of the state. While uniform standards resulting from cooperative endeavors can be useful, efforts to impose arbitrary standardization and uniformity should be resisted. Instruction and research are dynamic processes which should be engaged in constant development and change. A system of computing services in support of these processes should encourage change and be responsive to it. Several professional societies have recommended that adequacy of computing facilities become part of the criteria for accreditation. Such prospect is realistic, and it is timely to anticipate it now.

Computing is viewed as a key element in the future of higher education and one which will require heavy financial support of increasing magnitude. It is an overriding principle that individually and collectively the institutions of the state will enjoy the best computing services at the most desirable cost if they pursue a course of coordination and cooperation. This plan speaks to an approach and mechanism for coordination and cooperation based on the premise that both can be achieved without compromising our institutions' quest of their self-determined goals.

Coordination and cooperation imply sharing of computer hardware, software and expertise. Sharing in computing implies a network technically

linking diverse computer facilities in separate locations and an organizational structure for managing participation. A principle of participation is that all institutions should be provided equal opportunity of access to computing services which are responsive to their needs at a feasible cost. Clearly implied is the expectation that a portion of an institution's needs will be met locally through the use of hardware which may be linked to other facilities or may be independent of any network. To be successful any plan for computing for higher education must be characterized as being user oriented.

As mentioned earlier, the traditional approach to providing computer services whereby each institution continues the present process of independently developing its own solutions, is no longer viewed as viable. The contemporary approach of collective development and a sharing of resources through networking is the approach which is recommended. Networking has been referred to as the single most important idea in computing[1] for public higher education which has evolved in the last five years.

Two basic forms of networks have been described - centralized and distributed.[2] While both are technically feasible and each has certain advantages, they represent disparate philosophies for the provision of computer services. The assumptions of the Computing Services Policy Committee unmistakably imply a distributed network.

In the process of developing a network, the question arises as to whether there should be a commitment to either a homogeneous or a heterogeneous approach. A homogeneous network requires the nodal computers to be at least of the same brand, a heterogeneous network, different brands. The subscription of the same brand presents the disadvantages of possible loss of initiative, build up of inertia and reliance on a particular vendor. The major advantages of a heterogeneous network are the freedom to select the best hardware and the ability to capitalize on and preserve the unique resources at each node. This latter aspect is particularly attractive because it permits institutional diversity which in many instances is the key in bringing about educational innovation and experimentation. In an advanced stage of development, load balancing may be effected in a distributed network. This feature can be very useful in easing the peak loads among the institutions having different academic calendars, different daytime and evening programs requiring computing resources and as backup to each other. In view of the rapid decrease of the cost of terminals and switching computers, message switching has become increasingly competitive[3] with pure circuit switching, the method usually touted as one of the major advantages of a homogeneous network. The principle is therefore advanced that a commitment to a homogeneous network should not be made. While a heterogeneous network need not be viewed as a necessary goal, it is the considered approach of choice.

One conspicuous characteristic of computing in the educational environment is the existence of a multitude of direct users whose demands

span the entire spectrum of sophistication. For interactive on-line responsive systems, McKenney[4] reported the taxonomy of users and their varying degrees of sophistication in applying computing services. Another characteristic of academic computing is the relatively small and simple demand on computing resources by the majority of users. Empirical results tend to uphold the contention that 80% of the users use 20% of the computing resources. This majority is populated predominantly by users at the lower end of the spectrum of sophistication and almost all their demands can be satisfied by computers of nominal capability. There exists a hierarchy of users as well as a hierarchy of computer hardware. If the principle of "Matching tools to tasks" is applied to academic computing, it would be reasonable and even effective to use computers of varying capabilities to meet the different needs. Indeed this has been the experience in many universities. Taking all factors together, the concept of hierarchical computing is considered to be a viable alternative not only because it is logically sound but, with proper implementation, can also be cost effective.

The above remarks deserve extensive elaboration in order to fully document the basis for the committee's views on networking. However, for the purposes of the plan, the recommendation is advanced that a heterogeneous, hierarchical, distributed network constitutes the best alternative to achieve the long-range goal of providing computing resources for the institutions of higher education in the Commonwealth.

It is recognized that specialized computing needs exist in Kentucky's universities. Laboratory experimentation on computers in the engineering and computer science programs and process control related studies in natural and applied sciences are examples of special purpose application. Perhaps the most impressive examples can be found in the university teaching hospitals where the application of computers to patient care related systems is assuming ever increasing importance. Such needs can best be satisfied on an individual basis. Computers dedicated to patient care related activities, and involved in other special application are clearly justified hardware requirements and the linking of such computers to a distributed network should not be mandatory.

While a network for public higher education in Kentucky is the primary focus of the plan, the possibility and perhaps the desirability of providing service to private institutions of the state should not be overlooked. From the technical standpoint, there is no reason why such services could not be provided. One of the important long range advantages of a distributed network serving the institutions of Kentucky is the potential for linking Kentucky's network into other state, regional, national, and international systems.

As the Council on Public Higher Education discharges its coordinating function, policies and actions should reflect an awareness that cost effectiveness of hardware utilization cannot be the primary criterion by which proposals for computing facilities and programs are judged. Research and development, a characteristic of higher education, is rarely

cost effective in and of itself. Impact of proposed changes in hardware, software and systems should be analyzed in terms of the specific programs of institutions involved. These resources may be only a small portion of the total resources applied in the implementation of programs. Frequently ignored is the cost or value of faculty time invested in program development or the consequences to students of disrupted or delayed educational experiences.

The state of the art in networking among educational institutions is still in the stage of development. At present, the limitation is not technical capacity, but feasibility of cost and creditability of management alternatives. The ultimate in coordination and cooperation through networking will not be achieved in Kentucky in a span of five years. A step-wise approach of evolution is both practical and desirable.

To achieve a user-services network, there will be required a considerable change in attitudes within and among institutions in the state, the Council on Public Higher Education, and state government. Major problems to be overcome are organizational, political and economic in nature, rather than technical. Progress will be measured by the degree of trust which can be placed in the motives and methods of those who control the implementation of the plan and by the good faith exhibited by those who participate.

POLICIES

A number of policies will be required to direct the development of computing services for public higher education over the next five years.

The policies should address such items as; the protection of on-going programs; the preservation of the hierarchical network of machines; economics of scale; financial support; institutional priorities and standards; impact of proposed changes in hardware, software and systems; and the expertise needed to provide the services both at the computer site and the local user site.

ORGANIZATION

Of major importance to the future of computing for higher education is the organizational structure which is applied to the implementation and management of the Kentucky Educational Computer Network (KECNET). A system as complex as the one recommended in this plan will not function on an ad hoc basis in the absence of strong direction. Two principles must be satisfied by any management scheme. First, management authority must reside in one individual who will be responsible for day to day management and responsive to users' request for assistance. Second, the promulgation of rules and regulations under broader Council policy and the authority of adjudication between users must reside in a body comprised of representatives of all institutional users. Fiscal policy and budget recommendations will originate in the governing body while fiscal management will reside with the manager.

Under the auspices of the Council on Public Higher Education, a Kentucky Educational Computer Board, (KECOMB) was organized as a permanent agent to manage the KECNET. Under KECOMB, there are three organisms: Committee of Computer Center Directors, KECNET, and University Users Group. Figure 1 shows the organizational chart for KECOMB.

KECOMB is composed of the Executive Director of the Council on Public Higher Education and the presidents of the participating institutions or their designates. The chairman of KECOMB is elected by its members, KECOMB is scheduled to meet at least four regular meetings each year, and the chairman is responsible for presenting an annual report to the Council on Public Higher Education within one month after the conclusion of each fiscal year.

The basic function of KECOMB deals with the establishment of policies for the proper operation of KECNET. As the executive body of KECNET, KECOMB is responsible for the conduct of relevant interagency business. The autonomy in program determination and diversity of the universities must be scrupulously observed and maintained.

The function of the Committee of Computer Center Directors is to advise KECOMB on technical matters. Participating members are thus users, resource suppliers, and those providing coordination. The membership of the Computer Center Directors are not appointed by KECOMB. This committee holds meetings at least four times a year. The chairman, elected by the members, is required to submit a report to KECOMB annually in the month of July.

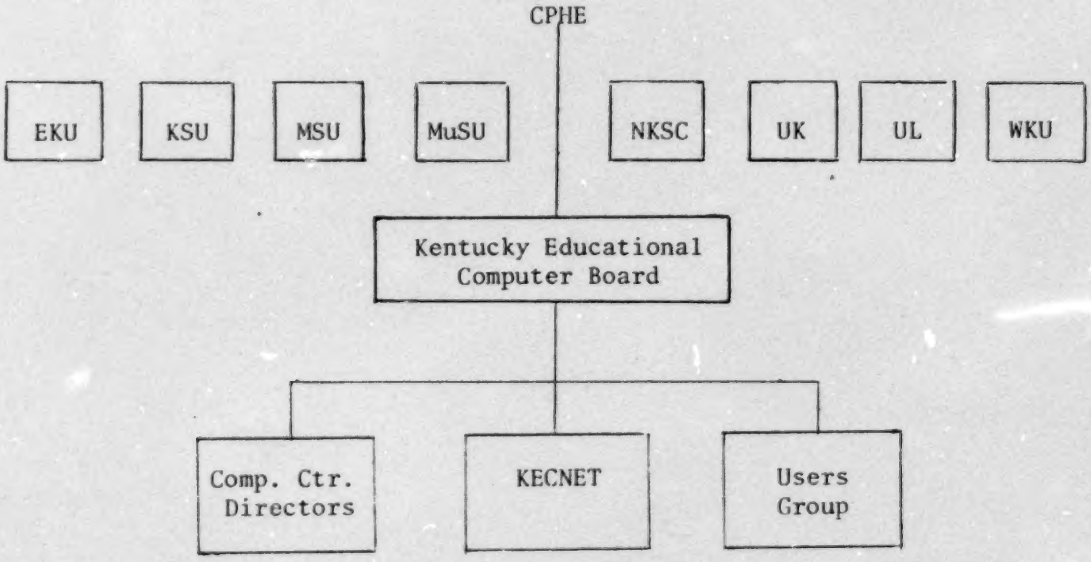
The University Users Group consists of at least two members from each of the eight universities, representing both academic and administrative computing. There is no preset limit on the number of members. The function of this group includes, but is not limited to, applications software coordination, computer assisted instruction exchange, and the conduct of applications workshops.

KECNET is the administrative body responsible for the day-to-day operation of the network. It has a manager, appointed by KECOMB, and at least two professional staff members. KECNET is the supplier of data transmission service and communications facility service. The coordinator is responsible for the development and maintenance of a comprehensive users' manual for the KECNET, administers the fund pool provided by the Council on Public Higher Education, and serves as a clearing house for inter-university accounts (cross-charges). The responsibility for the operating budget of KECNET is that of the Council on Public Higher Education and not of the universities.

It should be emphasized that the organizational and management scheme has as its focus the provision of computing services and not the management of academic or administrative programs supported by these services.

Figure 1

Organizational Chart of the
Kentucky Educational Computer Board



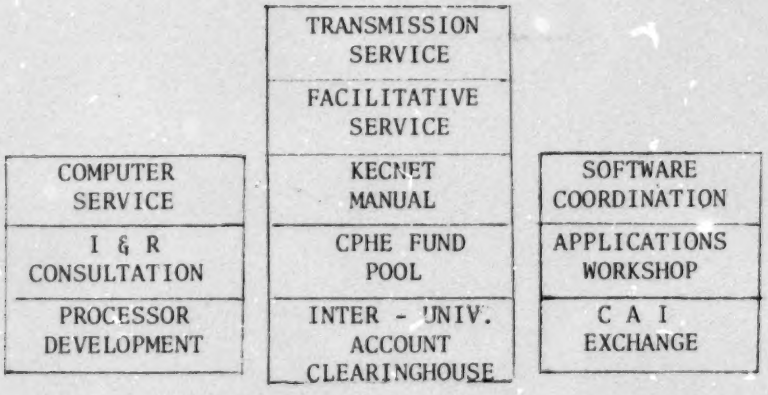
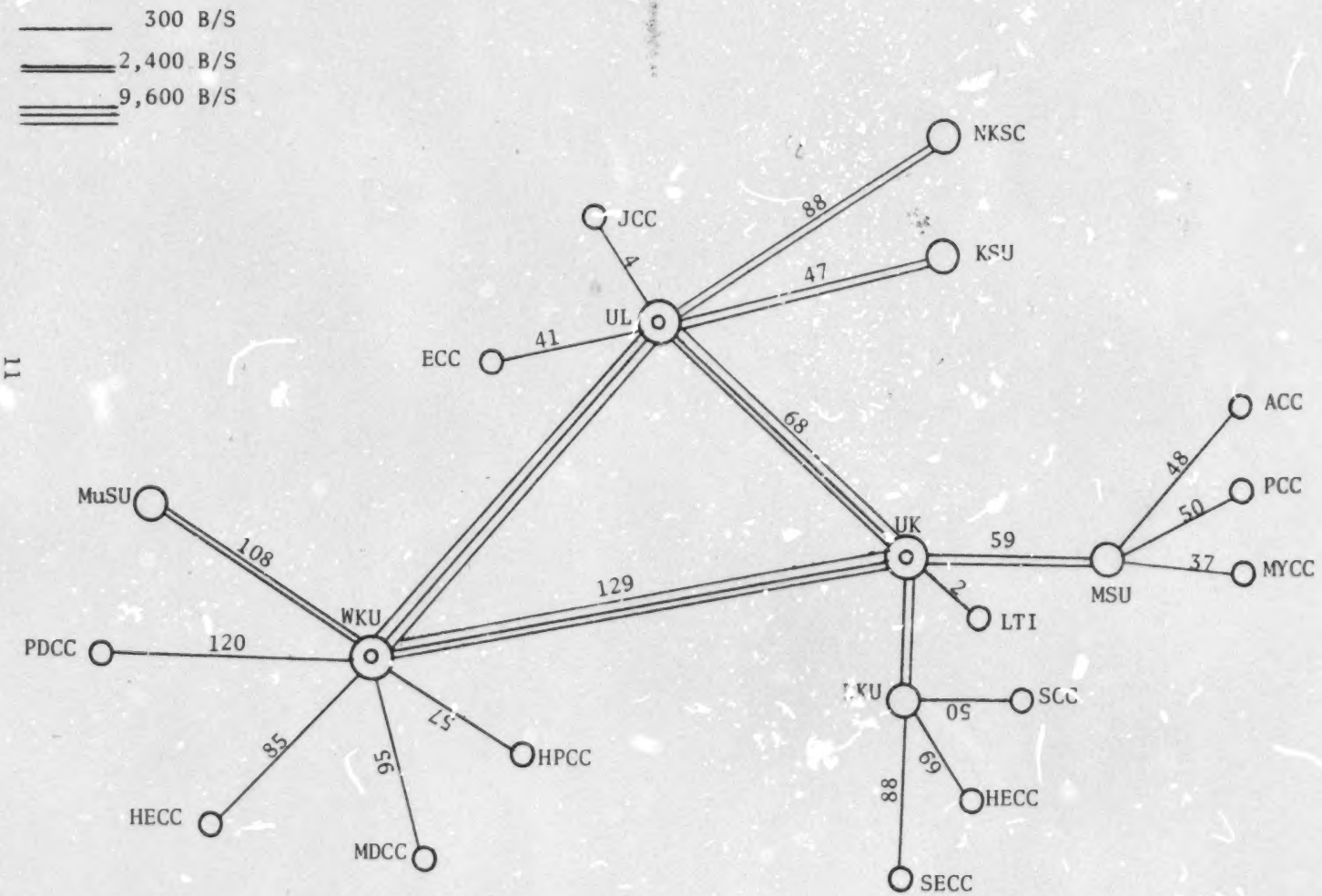


Figure 2
KECNET



CONCLUSION

As is evidenced by the foregoing, the Kentucky plan is highly user oriented. The plan was developed to provide three major components: (1) computing services, (2) communication facilities, and (3) consulting services. The assumptions, policy recommendations and organization are directed toward responding to the user's needs. Direction and decision are now concentrated at the executive level through the involvement of the Presidents on the KECOMB.

At present KECNET consists of two supplier nodes. The design is modular in concept to allow growth from a modest two-node size to a large complex network of interacting nodes which supply a myriad of services. Efforts are currently directed more toward the development of communication facilities to provide the most efficient access to all institutions.

In developing the Five-Year Plan, attention was directed to those networks which appear to be successful.

They have a degree of commonality in their approach: (1) sensitivity to the user population, (2) location of the processing centers, (3) availability of adequate communication systems, and (4) a demonstrated economy of scale over other methods of supply of computing services. The emphasis must be on services rather than hardware. A superior plan for educating the user is perhaps the critical element of success and encompasses more than the individual at the remote terminal. In essence, it includes various levels of training for all members of the organization involved at the user site. The need for balance between supply of and demand for computer services is omnipresent and must be addressed through well thought out policies and procedures.

The existence of various manufacturers' computing equipment located on the campuses at the time the network was considered caused the plan to be of a heterogeneous nature with regard to equipment. Perhaps the major benefits to be derived from the networking arrangement transcend the actual hardware aspects and are to be found in the stimulation associated with the sharing of expertise among the users of the service.

While the Kentucky Educational Computing Network is relatively new, it appears to have gained from the experiences of the older networks and is designed to be highly user oriented with built-in mechanisms to assure sensitivity to the needs of the ultimate consumer of the computing services. Time may require drastic change to the network concepts; however, change can be accommodated due to the high degree of flexibility incorporated into the design of the system.

It is the prediction of those involved that networking offers a greater potential to the delivery of computing services to a larger constituency than any current alternative available.

REFERENCES

[1]"Planning for National Network," page 89, EDUCOM, 1973.

[2]"Networks for Higher Education," pages 19-20, EDUCOM, 1972.

[3]David, E. E., Jr., "Computing from the Communication Point of View," page 127, Advances in Computers, V 10, 1970.

[4]Greenberger et al, "Networks for Research and Education," pages 146-147, MIT Press, 1974.

[5] "Computing Policies and Services for Higher Education in Kentucky-Five Year Plan," August, 1975.